NASA TECH BRIEF

Marshall Space Flight Center

Computer Program To Generate Attitude Error Equations
For A Gimballed Platform

The problem:

To find a method by which attitude error equations, suitable for use in a flight program, can be generated for a platform with a given gimbal order. The generation of the equations requires the expansion and reduction of seven third-order matrices for a four-gimbal platform. Once expanded, the equations can be reduced using fundamental trigonometric identities for the sum of two angles. The expansion and subsequent reduction of these equations is time consuming, tedious, and virtually impossible to perform without error.

The solution:

A computer program was developed which will generate the matrix elements of the attitude error equations when the initial matrices and trigonometric identities have been defined and provided as program input.

How it's done:

Through the use of an extension of the OS/360 PL/I (F) compiler, known as the PL/I-FORMAC interpreter, the matrices whose elements are the sines and cosines of the guidance commands and related gimbal angles can be multiplied to form the matrix product, and like terms can be collected for each element of the product.

Input to the program consists of up to seven input matrices entered in PL/I data-directed format on cards. Output is a printout of individual matrix elements for each matrix product. A final matrix product after reduction of terms using trigonometric identities is also printed.

The process used to generate equations in this program can be used whenever matrix manipulation is required. Use of this program enables one to obtain equations in a linear form rather than a matrix form. This is useful, as well as cost effective, when a program is implemented which will be run many times as in the case of simulations.

Notes:

1. This program is written in PL/I-FORMAC to be utilized on the IBM-360/75 computer. 260 K bytes of storage, a 9-track tape drive and 2311 disk drive are required to run the present version.
2. Inquiries concerning this program should be directed to:

    COSMIC
    112 Barrow Hall
    University of Georgia
    Athens, Goergia 30601
    Reference: MFS-21991

Source: Willaim A. Hall, Jr.,
Thomas D. Morris, and
Kyle Y. Rone of
IBM Corp.
under contract to
Marshall Space Flight Center
(MFS-21991)

Category 09